an appropriate intensity of light in each case to balance the gravity stimulus without any effect on geotropic sensitiveness itself. Thus in the coleoptile of *Avena sativa* light of about 55 meter-candles, in the hypocotyls of *Brassica Napus*, *Lepidium sativum*, and *Agrostemma Githago* respectively 525, 666, 1026 m.-c., compensates gravity when each stimulus acts at 90°. When equivalent light acts at right angles to gravity (plants vertical, light horizontal) the parallelotropic organs take a resultant position, departing about 45° from the direction of each. On the elimination of the one-sided action of gravity by the clinostat, however, they become parallel to the light rays; but even in the final position of rest they have not lost their sensitiveness to gravity.

The geotropic series of reactions is quicker than the heliotropic, when the light is reduced to the compensating point; consequently, when light and gravity act antagonistically, the geotropic curvature appears first, and the maximum of heliotropic stimulation does not appear until much later. While these results are strictly true only for the plants observed, yet the principle is probably valid for others.—C. R. B.

Development of Juniperus.—Two preliminary accounts of fertilization in Juniperus were noted in this journal (**40**:318. 1907). The two accounts differed mainly in regard to time relations, NORÉN stating that the interval between pollination and fertilization was over a year, while SLUDSKY claimed that the development from megaspore to embryo occupies only a single summer. The present account[11] shows that NORÉN was right, SLUDSKY having made a mistake in estimating the age of the cones. The pollen grain in the uninucleate condition reaches the nucellus the middle of June and soon divides into a tube cell and generative cell, the latter remaining undivided until the following May, when it forms the stalk and body cells. Early in July the body cell gives rise to two equal male cells. In the nucellus there are several sporogenous cells, only one of which divides to form megaspores, the others becoming a nutritive jacket about the functioning megaspore. Usually only three cells of the tetrad are formed. In the archegonium there are four neck cells; and a ventral canal nucleus is formed, but never becomes separated from the egg by a wall. Fertilization occurs about the middle of July and the fusion nucleus passes to the bottom of the egg, where three mitoses give rise to eight free nuclei which become arranged in two zones. Walls now appear and the cells of the upper zone divide to form the rosette and suspensor.

The account is very full, cytological details of reduction and fertilization being figured and described.—CHARLES J. CHAMBERLAIN.

Hygroscopic movements of living leaves.—The leaves of some species of Rhododendron exhibit variation movements which follow the recurrence of freezing and thawing weather. The usual position of the leaves is horizontal, with the blade expanded. At freezing temperatures the edges of the leaves curl

[11] NORÉN, C. O., Zur Entwickelungsgeschichte des *Juniperus communis*. Uppsala Universitets Ärsskrift **1907**: 1–64. *pls. 4.*